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Century**

# COSMIC TRANSIENTS

*will involve the ongoing study of cosmic transients*

Transient cosmic phenomena are some of modern science's most enigmatic subjects. Their transient nature means they might last less than a few seconds and so they often fall outside the realm of traditional optical astronomy. Los Alamos scientists have studied cosmic transients for years and continue to develop cutting-edge science and technologies for their study.

Los Alamos scientists discovered gamma-ray bursts originating from space in the 1960s using the Vela satellites and that was to be only the beginning of the Laboratory's affinity for space phenomena. Since that time, Los Alamos scientists have contributed extensively to advances in transient research. One of the most remarkable of these advances came in January 1999 when the optical counterpart of a gamma ray burst was observed by ROTSE-I — the Robotic Optical Transient Search Experiment, while the gamma rays were still arriving. This was the first time in history such an observation had been made.

Fenton Hill Observatory is home to much of the cosmic transient research at Los Alamos. Located 35 miles from Los Alamos in the Jemez Mountains, the observatory has several unique telescopes used in transient research.

REACT, or Research and Education Automatically Controlled Telescope, is a robotic telescope with a one-half-degree field of view which can automatically swing around to take a series of high-resolution photos to capture any optical signals that might coincide with gamma-ray transients seen by other sky-watching instruments. As the name implies, the telescope is also used in educational outreach to bring the stars closer to New Mexico high school students.

Watching the sky with ROTSE and REACT at Fenton Hill is Milagro. Milagro is a Cherenkov detector that uses more than 800 sensitive light detectors submerged in a five-million-gallon artificial pond to detect signals from high-energy cosmic emissions, including gamma ray bursts. Acting like a camera whose shutter is always open, Milagro stares continuously at the sky, day and night from horizon to horizon.

Future cosmic transient studies at Los Alamos will include refining current and developing new techniques and technologies for cosmic transient research as well as explorations into the theory and modeling of transient phenomena. The next generation of ROTSE telescopes, ROTSE-II, is already under development and someday a network of ROTSE-II telescopes may scan the night sky from locations around the globe.

In the future, the Radio Interferometer Transient Experiment, or RITE, will eventually place a small contingent of surplus satellite television dishes at Fenton Hill. These ordinary stationary dishes will be aimed at the sky and use the rotation of the Earth to repeatedly monitor a narrow region of the sky. By combining the radio wave signals received from all the dishes, an image of radio sources coming from space will be created. Comparing each day's image with the previous day's image will allow the detection of transient radio sources.

Given what little we now know about transients, it seems the opportunities and directions for future research could be as vast as the universe itself.

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